

CLAIMS

1. A heat pump apparatus including an evaporator means, a control means in communication with at least one sensor means adapted to measure one or more variables representative of a temperature of an outer surface of said evaporator means, and a heat exchanger means operable to add heat from a working fluid from a high pressure side of said heat pump apparatus to said working fluid entering said evaporator means, wherein said control means is operatively connected with said heat exchanger means to add said heat when said control means determines that said temperature of said outer surface of said evaporator means is below a pre-selected temperature, thereby reducing or substantially eliminating the formation of ice on said outer surface of said evaporator means.
2. A heat pump apparatus including an evaporator means, a control means in communication with at least one sensor means adapted to measure one or more variables representative of a temperature of an outer surface of said evaporator means, and a heat exchanger means including a heating element positioned upstream of said evaporator means and downstream of an expansion means of said heat pump apparatus, the heat exchanger means operable to add heat to a working fluid entering said evaporator, wherein said control means is operatively connected with said heat exchanger means so that when said control means determines that said temperature of said outer surface of said evaporator means is below a pre-selected temperature, the heat exchanger means adds heat to said working fluid thereby reducing or substantially eliminating formation of ice on said outer surface of said evaporator means, and wherein said heat exchanger includes a helically corrugated tube positioned within an outer housing, and said working fluid being heated is caused to flow over said tube and between said tube and said outer housing.
3. A heat pump apparatus as claimed in claim 1 or claim 2 wherein said at least one sensor means includes a temperature sensor adapted to measure the temperature of said outer surface of said evaporator means.
4. A heat pump apparatus as claimed in any one of the preceding claims wherein

said at least one sensor means includes a temperature sensor adapted to measure the temperature of the working fluid exiting the evaporator means.

- 5 5. A heat pump apparatus as claimed in any one of the preceding claims wherein at least one sensor means includes a temperature sensor adapted to measure the temperature of the environment surrounding the evaporator means.
- 10 6. A heat pump apparatus as claimed in any one of the preceding claims wherein at least said sensor means includes a pressure sensor adapted to measure the pressure of the working fluid exiting the evaporator means.
7. A heat pump apparatus as claimed in any one of the preceding claims wherein said heat exchanger means includes an electric heating element.
- 15 8. A heat pump apparatus as claimed in claim 7 when dependent on claim 2 wherein said electric heating element extends through said helically corrugated tube.
9. A heat pump apparatus as claimed in claim 8 wherein said helically corrugated tube forms part of an electrical circuit of the electric heating element.
- 20 10. A heat pump apparatus as claimed in any one of the preceding claims and including a compressor and a condenser and where said heat exchanger means obtains heat from said working fluid between said compressor and said condenser to transfer said heat to said working fluid entering said evaporator means.
- 25 11. A heat pump apparatus as claimed in any one of the preceding claims wherein said pre-selected temperature is between about 4° C and 0°C.
- 30 12. A heat pump apparatus as claimed in claim 1 wherein said heat exchanger means includes a helically corrugated tube positioned in an outer housing, said working fluid from said high pressure side being caused to flow through said tube to add heat to said working fluid caused to flow over said tube and
- 35 between said tube and said outer housing.

13. A heat pump apparatus substantially as herein described with reference to Figure 1 or Figure 3, or Figure 1 or Figure 3 in conjunction with any one of Figures 2A, 2B, 4, 5, 6 or 7A and 7B of the accompanying drawings.
- 5 14. A method of operating a heat pump having an evaporator downstream of an expansion means, the method including obtaining heat as required from a working fluid on a high pressure side of said heat pump to transfer to said working fluid on a low pressure side of said heat pump, prior to said working fluid entering said evaporator to reduce or substantially prevent ice from forming on the outer surface of said evaporator.
- 10 15. A method as claimed in claim 14 wherein the method includes measuring one or more variables representative of a temperature of an outer surface of said evaporator and adding said heat to the working fluid entering said evaporator when said one or more variables indicate that said temperature has dropped below a pre-selected minimum.
- 15 16. A method as claimed in claim 14 or claim 15 wherein said method further includes providing a controller to determine when icing of said evaporator is imminent based on said measurement of one or more variables.
- 20 17. A method as claimed in any claims 14 to 16 wherein the method includes heating the working fluid entering said evaporator with an electric heating element.
- 25 18. A method as claimed in any one of the claims 14 to 17 wherein the said high pressure side is between a compressor and a condenser of heat pump.
- 30 19. A method as claimed in any one of the claims 14 to 18 in which said low pressure side of said heat pump is provided with a heat exchanger; said method including providing said heat exchanger with a helically corrugated tube within an outer housing, said working fluid being caused to flow over said tube and between said outer housing to be heated before it enters said evaporator.
- 35 20. A method as claimed in any one of claims 14 to 19 wherein the method includes adding heat to said working fluid while said heat pump is in operation.

21. A heating apparatus for a fluid circuit including a heat exchanger means operable to add heat to a fluid flowing in said circuit, at least one sensor means adapted to measure one or more variables representative of a temperature of said fluid, a control means in communication with said at least one sensor means and operatively connected with said heat exchanger means to add heat to said fluid when said control means determines that said temperature is below a pre-selected temperature.

22. A method of operating a heat pump substantially as herein described with reference to any one of the embodiments of the present invention and with reference to the accompanying drawings.